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SCIENCE AND LITERATURE

BY JOHN BURROUGHS

It is not in the act of seeing things or apprehending facts that we differ so much from one another, as in the act of interpreting what we see or apprehend. Interpretation opens the door to the play of temperament and imagination, and to the bias of personality. A mind that has a lively fancy and a sense of mystery will interpret phenomena quite differently from a mind in which these things are absent. The poetic, the religious, the ethical mind, will never be satisfied with the interpretation of the physical universe given us by the scientific mind. To these mental types such an interpretation seems hard and barren; it leaves a large part of our human nature unsatisfied. If a man of science were to explain to a mother all the physical properties, functions, and powers of her baby, and all its natural history, would the mother see her baby in such a portraiture? Would he have told her why she loves it? It is the province of literature and art to tell her why she loves it, and to make her love it more; of science to tell her how she came by it, and how to secure its physical well-being. Literature interprets life and nature in terms of our sentiments and emotions; science interprets them in terms of our understanding.

The habit of mind begotten by the contemplation of nature, and by our emotional intercourse with her, is in many ways at enmity with the habit of mind begotten by the scientific study of nature. The former has given us literature, art, religion; out of the latter has come our material civilization. Out of it has also come our enlarged conception of the physical universe, and a true insight as to our relations with it, albeit this gain seems to have been purchased, more or less, at the expense of that state of mind that in the past has given us the great poets and prophets and religious teachers and inspirers.

As I have said, the two types of mind, the scientific and the artistic, the analytic and the synthetic, look upon nature and life with quite different eyes. Wordsworth said of his poet that he was "contented to enjoy what others understood." When Whitman, as he records in one of his poems, fled from the lecture-hall where the "learned astronomer" was discoursing about the stars, and in silence gazed up at the sky gemmed with them, he showed clearly to which type he belonged. Tyndall said that men of warm feelings, with minds open to the elevating impressions produced by nature as a whole, whose satisfaction therefore is rather ethical than logical, lean to the synthetic side, while the analytic harmonizes best with the more precise and more mechanical bias which seeks the satisfaction of the understanding. Tyndall said of Goethe that while his discipline as a poet went well with his natural history studies, it hindered his approach to the physical and mechanical sciences: "He could not formulate distinct mechanical conceptions; he could not see the force of mechanical reasoning," as Tyndall himself could see it. Tyndall was a notable blending of the two types of mind; to his proficiency in analytical and experimental science he joined literary gifts of a high order. It is these gifts that make his work rank high in the literature of science.

Tyndall was wont to explain his mechanistic views of creation to Carlyle, whom he greatly revered. But Carlyle did not take kindly to them. This was one of the phases of physical science which repelled him. Carlyle revolted at the idea that the sun was the physical basis of life. He could not endure any teaching that savored of materialism. He would not think of the universe as a machine, but as an organism. Igdrasil, the Tree of Life, was his favorite image. Considering how the concrete forces of the universe circulate and pull together, he found no similitude so true as that of the tree—"Beautiful, altogether beautiful and great," said he. "The Machine of the universe—alas! do think of that in contrast!"

Carlyle was a poet and a prophet and saw the world through his moral and spiritual nature, and not through his logical faculties. He revolted at the conception of the mystery we name life being the outcome of physical and chemical forces alone.

Literature, art, and religion are not only not fostered by

the scientific spirit, but this spirit, it would seem, is almost fatal to them, at least so far as it banishes mystery and illusion, and checks or inhibits our anthropomorphic tendencies. Literature and art have their genesis in love, joy, admiration, speculation, and not in the exact knowledge which is the foundation of science. Our creative faculties may profit by exact knowledge of material things, but they can hardly be inspired by it. Inspiration is from within, but scientific knowledge is from without.

There is no literature or art without love and contemplation. We can make literature out of science only when we descend upon it with love, or with some degree of emotional enjoyment. Natural history, geology, biology, astronomy, yield literary material only to the man of emotion and imagination. Into the material gathered from outward nature the creative artist puts himself, as the bee puts herself into the nectar she gathers from the flowers to make it into honey. Honey is the nectar plus the bee; and a poem, or other work of art, is fact and observation plus the man. In so far as scientific knowledge checks our tendency to humanize nature, and to infuse ourselves into it, and give to it the hues of our own spirits, it is the enemy of literature and art. In so far as it gives us a wider and truer conception of the material universe, which it certainly has done in every great science, it ought to be their friend and benefactor. Our best growth is attained when we match knowledge with love, insight with reverence, understanding with sympathy and enjoyment; else the machine becomes more and more, and the man less and less.

Fear, superstition, misconception, have played a great part in the literature and religion of the past; they have given it reality, picturesqueness, and power; it remains to be seen if love, knowledge, democracy, and human brotherhood can do as well.

The literary treatment of scientific matter is naturally of much more interest to the general reader than to the man of science. By literary treatment I do not mean taking liberties with facts, but treating them so as to give the reader a lively and imaginative realization of them—a sense of their esthetic and intellectual values. The creative mind can quicken a dead fact and make it mean something in the emotional sphere.

When we humanize things, we are beyond the sphere of

science and in the sphere of literature. We may still be dealing with truths, but not with facts. Tyndall, in his *Fragments*, very often rises from the sphere of science into that of literature. He does so, for instance, in considering the question of personal identity in relation to that of molecular change in the body. He asks:

How is the sense of personal identity maintained across this flight of the molecules that goes on incessantly in our bodies, so that while our physical being, after a certain number of years, is entirely renewed, our consciousness exhibits no solution of continuity? Like changing sentinels, the oxygen, hydrogen, and carbon that depart seem to whisper their secret to their comrades that arrive, and thus, while the Non-ego shifts, the Ego remains the same. Constancy of form in the grouping of the molecules, and not constancy of the molecules themselves, is the correlative of this constancy of perception. Life is a *wave* which in no two consecutive moments of existence is composed of the same particles.

Tyndall has here stated a scientific fact in the picturesque and poetic manner of literature. Henri Bergson does this on nearly every page. When his subject-matter is scientific, his treatment of it is literary. Indeed, the secret of the charm and power of his *Creative Evolution* is the rare fusion and absorption of its scientific and philosophical material by the literary and artistic spirit.

How vividly present Huxley is in everything he writes or speaks, the man shining through his sentences as if the sword were to shine through its scabbard—a different type from Tyndall, more controversial! A lover of combat, he sniffs the battle afar; he is less poetical than Tyndall, less given to rhetoric, but more a part of what he says, and having a more absolutely transparent style. How he charged the foes of Darwin, and cleared the field of them in a hurry. His sentences went through their arguments as steel through lead.

As a sample of fine and eloquent literary statement I have always greatly admired that closing passage in his essay on "Science and Morals" in which he defends physical science against the attacks of Mr. Lilly, who, armed with the weapons of both theology and philosophy, denounced it as the evil genius of modern days. Huxley says:

If the diseases of society consist in the weakness of its faith in the existence of the God of the theologians, in a future state, and in uncaused volitions, the indication, as the doctors say, is to suppress Theology and Philosophy, whose bickerings about things of which they

know nothing have been the prime cause and continual sustenance of that evil skepticism which is the Nemesis of meddling with the unknowable.

Cinderella is modestly conscious of her ignorance of these high matters. She lights the fire, sweeps the house, and provides the dinner; and is rewarded by being told that she is a base creature, devoted to low and material interests. But in her garret she has fairy visions out of the ken of the pair of shrews who are quarreling down-stairs. She sees the order which pervades the seeming disorder of the world; the great drama of evolution, with its full share of pity and terror, but also with abundant goodness and beauty, unrolls itself before her eyes; and she learns in her heart of hearts the lesson that the foundation of morality is to have done, once and for all, with lying; to give up pretending to believe that for which there is no evidence, and repeating unintelligible propositions about things beyond the possibilities of knowledge.

She knows that the safety of morality lies neither in the adoption of this or that theological creed, but in a real and living belief in that fixed order of nature which sends social disorganization upon the track of immorality as surely as it sends physical disease after physical trespasses. And of that firm and lively faith it is her high mission to be the priestess.

Herbert Spencer, so far as I have read him, never breathes the air of pure literature. "Life," says Spencer, "is a continuous adjustment of internal relations to external relations." In other words, without air, water, and food our bodies would cease to function and life would end. Spencer's definition is of course true so far as it goes, but it is of no more interest than any other statement of mere fact. It is like opaque and inert matter. Tyndall's free characterization of life as a "wave which in no two consecutive moments of its existence is composed of the same particles" pleases much more, because the wave is a beautiful and suggestive object. The mind is at once started upon the inquiry, What is it that lifts the water up in the form of a wave and travels on, while the water stays behind? It is a force imparted by the wind, but where did the wind get it, and what is the force? The impulse we call life lifts the particles of the inorganic up into the organic, into the myriad forms of life—plant, tree, bird, animal—and, when it has run its course, lets them drop back again into their former inanimate condition.

Although Tyndall and Huxley possessed fine literary equipments, making them masters of the art of eloquent and effective statement, they were nevertheless on their guard against any anthropomorphic tendencies. They were not **unaware** of the emotion of the beautiful, the sublime, the

mysterious, but as men of science they could interpret evolution only in terms of matter and energy. Most of their writings are good literature, not because the authors humanize the subject-matter and read themselves into nature's script, but because they are masters of the art of expression, and give us a lively sense of the workings of their own minds.

Spencer was foreordained to the mechanistic view of life. His mind moves in the geometric plane. It is a military and engineering intellect applied to the problems of organic nature. How smoothly and orderly his intellect runs, with what force and precision, turning out its closely woven philosophical fabric as great looms turn out square miles of textiles, without a break or a flaw in the process. Never was a mind of such power so little inspired; never was an imagination of such compass so completely tamed and broken into the service of the reasoning intellect. There is no more aerial perspective in his pages than there is in a modern manufacturing plant, and no hint whatever of "the light that never was on sea or land." We feel the machine-like run of his sentences, each one coming round with the regularity and precision of the revolving arms of a patent harvester, making a clean sweep and a smooth cut; the homogeneous and the heterogeneous, the external and the internal, the inductive and the deductive processes, alternating in a sort of rhythmic beat like the throb of an engine. Spencer had a prodigious mind crammed with a prodigious number of facts, but a more juiceless, soulless system of philosophy has probably never emanated from the human intellect.

The tendency to get out of the sphere of science—the sphere of the verifiable—into the sphere of literature, or of theology, or of philosophy, is pronounced, even in many scientific minds. It is pronounced in Sir Oliver Lodge, as seen in his book on *Science and Immortality*. It is very pronounced in Alfred Russel Wallace; in fact, in his later work his anthropomorphism is rampant. He has cut more fantastic tricks before the high heaven of science than any other man of our time of equal scientific attainments. What a contrast to the sane, patient, and truth-loving mind of Darwin! Yet Darwin, it seems to me, humanized his birds when he endowed the females with human femininity, attributing to them love of ornament and of fine plumage, and making

this love of ornamentation the basis of his theory of sexual selection. It seems as though in that case he could not find the key to his problem, and so proceeded to make one—a trick to which we are all prone.

Since science dehumanizes nature, its progress as science is in proportion as it triumphs over the anthropomorphic character which our hopes, our fears, our partialities, in short, our innate humanism, has bestowed upon the outward world. Literature, on the other hand, reverses this process, and humanizes everything it looks upon; its products are the fruit of the human personality playing upon the things of life and nature, making everything redolent of human qualities, and speaking to the heart and to the imagination. Science divests nature of all human attributes and speaks to impersonal reason alone. For science to be anthropomorphic is to cease to be science; and for literature to be anything else is to fail as literature. Accordingly, the poet is poet by virtue of his power to make himself the center and focus of the things about him, but the scientific mind is such by virtue of its power to emancipate itself from human and personal consideration and rest with the naked fact. There is no art without the play of personality, and there is no science till we have escaped from personality, and from all forms of the anthropomorphism that doth so easily beset us. It is not that science restricts the imagination; it is that it sterilizes nature, so to speak, reducing it to inorganic or non-human elements. This is why the world, as science sees it, is to so many minds a dead world.

When we find fault with science, and accuse it of leading us to a blank wall of material things, or of deadening our esthetic sensibilities, we are finding fault with it because it looks upon the universe in the light of cold reason, and not through that of the emotions. But our physical well-being demands the de-humanization of the physical world; until we see our true relation to the forces amid which we live and move—our concrete bodily relations—we are like children playing with fire, or with edged tools, or with explosives. Man made no headway against disease, against plague and pestilence, till he outgrew his humanistic views, dissociated these things from evil spirits and offended deities, and looked upon them as within the pale of natural causation. Early man saw and felt and heard spirits on all sides of him—in fire, in water, in air, but he controlled and made use of them

only so far as he was practically scientific. To catch the wind in his sails he had to put himself in right physical relation to it. If he stayed the ravages of flood or fire, he was compelled to cease to propitiate these powers as offended deities, and fight them with non-human forces, as he does to-day. And the man of to-day may have any number of superstitions about his relations to the things around him, and about theirs to him, but he is successful in dealing with them only when he forgets his superstitions and approaches things on rational grounds.

Our fathers who held that every event of their lives was fixed and unalterable, according to the decrees of an omnipotent being, could not have survived had their daily conduct been in harmony with their beliefs. But when ill, they sent for the doctor; if the house got afire, they tried to put the fire out; if crops failed, they improved their husbandry. They slowly learned that better sanitation lessened the death-rate; that temperate habits prolonged life; that signs and wonders in the heavens and in the earth had no human significance; that wars abated as men grew more just and reasonable. We come to grief the moment that we forget that nature is neither for nor against us. We can master her forces only when we see them as they are in and of themselves, and realize that they make no exception in our behalf.

The superstitious ages, the ages of religious wars and persecutions, the ages of famine and pestilence, were the ages when man's humanization of nature was at its height; and they were the ages of the great literature and art, because, as we have seen, these things thrive best in such an atmosphere. Take the gods and devils, the good and bad spirits, fate, and foreknowledge, and the whole supernatural hierarchy out of the literature and art of the past, and what have we left? Take it out of Homer and Æschylus and Vergil and Dante and Milton, and we come pretty near to making ashes of them. In modern literature, or the literature of a scientific age, these things play an insignificant part. Take them out of Shakespeare, and the main things are left; take them out of Tennyson, and the best remains; take them out of Whitman, and the effect is hardly appreciable. Whitman's anthropomorphism is very active. The whole universe is directed to Whitman, to you, to me; but Whitman makes little or no use of the old stock material of the poets. He seeks to draw into himself and to assimilate

and imbue with the human spirit the entire huge materialism of the modern democratic world. He gives the first honors to science, but its facts, he says, are not his dwelling,

I but enter by them to an area of my dwelling.

Being a poet, he must live in the world of the emotions, the intuitions, the imagination—the world of love, fellowship, beauty, religion—the super-scientific world. As practical beings with need of food, shelter, transportation, we have to deal with the facts within the sphere of physical science; as social, moral, and esthetic beings, we live in the super-scientific world. Our house of life has upper stories that look off to the sky and the stars. We are less as men than our fathers, have less power of character, but are more as tools and vehicles of the scientific intellect.

Man lives in his emotions, his hopes and fears, his loves and sympathies, his predilections, and his affinities, more than in his reason. Hence, as we have more and more science, we must have less and less great literature; less and less religion; less and less war; less and less racial and political antagonisms; more and more freedom and fellowship in all fields and with all peoples. Science tends to unify the nations and make one family of them.

The antique world produced great literature and great art, but much of its science was childish. We produce great science, but much of our literature and art is feeble and imitative.

Science, as such, neither fears nor dreads nor wonders nor trembles nor scoffs nor scorns; is not puffed up; thinketh no evil; has no prejudices; turns aside for nothing. Though all our gods totter and fall, it must go its way. It dispels our illusions because it clears our vision. It kills superstition because it banishes our irrational fears.

Mathematical and scientific truths are fixed and stable quantities; they are like the inorganic compounds; but the truths of literature, of art, of religion, of philosophy, are in perpetual flux and transformation, like the same compounds in the stream of life.

How much of the power and the charm of the poetic treatment of nature lies in the fact that the poet reads himself into the objects he portrays, and thus makes everything alive and full of human interest. He sees

The jocund day
Stand tiptoe on the misty mountain top;

he sees the highest peak of the mountain range to be

The last to parley with the setting sun;

he sees

The white arms out in the breakers tirelessly tossing;

while the power and the value of science is to free itself from these tendencies and see things in the white light of reason. Science is the enemy of our myth-making tendency, but it is the friend of our physical well-being.

Every material thing and process has its physics, which, in most cases, seem utterly inadequate to account for the thing as it stands to us. Life is a flower, and the analysis of it does not tell us why we are so moved by it. The moral, the esthetic, the spiritual values which we find in life and in nature, are utterly beyond the range of physical science, and I suppose it is because the physico-chemical explanation of the phenomenon of life takes no account, and can take no account, of these, that it leaves us cold and uninterested. Spencer, with his irrefragable mechanistic theories, leaves us indifferent, while Bergson, with his creative evolution, sets mind and spirit all aglow. One interprets organic nature in terms of matter and motion, the other interprets it in terms of life and spirit.

Science is the critic and doctor of life, but never its inspirer. It enlarges the field of literature, but its aims are unliterary. The scientific evolution of the great problems—life, mind, consciousness—seem strangely inadequate; they are like the scientific definition of light as vibrations or electric oscillations in the ether of space, which would not give a blind man much idea of light. The scientific method is supreme in its own sphere, but that sphere is not commensurate with the whole of human life. Life flowers in the subjective world of our sentiments, emotions, and aspirations, and to this world literature, art, and religion alone have the key.

JOHN BURROUGHS.